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# SOIL GAS SURVEY
# OF
# LEE ACRES SITE
# FARMINGTON, NEW MEXICO

Contract AA 852-RP6-7

JULY 1986

Prepared For:

United States Department of The Interior
Bureau of Land Management
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Submitted By:

Tracer Research Corporation

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## EXECUTIVE SUMMARY

- A total of 46 soil gas samples were analyzed during an investigation of the Lee Acres site near Farmington, New Mexico.

- The Lee Acres landfill was found to be a source of both halocarbon and hydrocarbon contamination.

- Results indicate that the El Paso Natural Gas facility and the Giant Refinery are other potential sources of hydrocarbon contamination.

## INTRODUCTION

A shallow soil gas investigation was conducted by Tracer Research Corporation (TRC) at the Lee Acres site near Farmington, New Mexico. The investigation was conducted July 8 - 11, 1986 under contract to the United States Department of the Interior, Bureau of Land Management. The primary objective was to delineate the distribution of volatile organic compounds (VOCs) in the subsurface underlying the site.

For this study, soil gas samples were analyzed for the following components:

Methylene Chloride ($CH_2CH1_2$)
Chloroform ($CHC1_3$)
1,1,1-Trichloroethane (TCA)
Trichloroethene (TCE)
Tetrachloroethene (PCE)
Benzene
Toluene
Ethyl Benzene
O-Xylene
Total Hydrocarbons
($C_1$ - $C_8$ Aliphatic and Aromatic Hydrocarbons)

The site contains two areas which are believed to be potentially responsible for contaminating private wells downgradient (to the south). One area is the Giant Refinery and the other the Lee Acres landfill. In the past, the landfill accepted liquid waste including produced waters from oil and gas fields in the region.

## BACKGROUND ON THE METHODOLOGY

The presence of volatile organic chemicals (VOCs) in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe.
The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing high vapor pressures and low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The groundwater acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the water table and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because surface distribution features of the observed compound are usually much larger in scale than the local anomalies and are defined using a large data base. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

## SAMPLING AND ANALYTIC PROCEDURES

Tracer Research Corporation (TRC) utilized an analytical field van which was equipped with two Varian 3300 gas chromatograph and Spectra Physics SP4270 computing integrators. In addition, the van has two built-in gasoline powered generators which provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. Probes consist of 7-foot lengths of 3/4 inch diameter steel pipe which are fitted with detachable drive points. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil.

Soil gas samples were collected by driving a hollow steel probe from 5.5 to 13 feet into the ground. The above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Five to 10 liters of gas was evacuated with a vacuum pump. During the soil gas evacuation, samples were collected by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for immediate analysis in the TRC analytical field van. Soil gas was subsampled (duplicate injections) in volumes ranging from 1 ul to 2 ml, depending on the VOC concentration at any particular location.

The gas chromatograph equipped with the electron capture detector was used for analyses of TCA, TCE, PCE, $CH_2Cl_2$, and $CHCl_3$. Analyses were performed on OV-101 packed columns. The gas chromatograph was equipped with a flame ionization detector which was used for the analysis of hydrocarbons.

Total hydrocarbons include as $C_1$ - $C_9$ aliphatic and

aromatic hydrocarbons are reported. The response factor for benzene (typically within 25% of other hydrocarbons) was used to calculate total hydrocarbons. Nitrogen was used as the carrier gas.

Detection limits are a function of the injection volume as well as the detector sensitivity for individual compounds. Thus, the detection limit varies with the sample size. Generally, the larger the sample, the greater the sensitivity. However, chromatographic peaks for compounds of interest must be kept within the linear range of the detector. If any compound has a high concentration, it is necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may cause decreased detection limits for other compounds in the analyses. The detection limits range down to .00005 ug/l for compounds such as TCA and PCE depending on the conditions of the measurement, in particular, the sample size. If any component being analyzed is not detected, the detection limit for that compound in that analysis is given as a "less than" value (e.g. <.0001 ug/l). This number is calculated from the current response factor, the sample size and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

Another factor which determines the sensitivity of the technique are the background concentrations which may be present at a given site. This background level is normally linked to the concentrations which are detected in ambient air. The end effect is that the background limits what can be identified as "significant" in the soil gas. For example at the Lee Acres Site, ambient air concentrations for TCA approached 0.001 ug/L. This figure only allowed TRC to identify concentrations greater than 0.01 ug/L as significant. This effect is true only for those compounds which have measureable air concentrations, in most cases only TCA and PCE.

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples. Prior to sampling, syringes were purged with nitrogen (i.e. carrier gas) and checked for contamination by injection into the gas chromatograph. System blanks were run periodically to confirm that there was no contamination in the probes, adaptors or 10 ml syringes. Soil gas probes, syringes and adaptors were used only once during the course of a working day and then thoroughly cleaned before use on the subsequent day. Analytical instruments were continuously checked for calibration by the use of chemical standards prepared in water from commercially available pure chemicals.

## RESULTS

A total of 46 soil gas samples were analyzed during an investigation at the Lee Acres site near Farmington, New Mexico. Analytical results are summarized in Appendix A. Maps showing sampling locations and isoconcentration contour lines are attached as Figures 1 through 5.

### Halocarbon Distribution

#### TCA

Concentrations for TCA at each sampling location as well as isoconcentration contour lines are attached as Figure 1. There is a source of TCA in the landfill with the highest concentrations of contaminant vapor being detected in the northern section. Contour lines show a trend which indicates a plume migrating off the landfill towards the south. Higher concentrations in the western section may be from an area which is also contributing to the plume. As reported by the New Mexico Enviornmental Improvement Division and Bureau of Land Managment Contracted Site Investigation Reports, private wells south of

U.S. Route 64 have shown detectable amounts of TCA.

### $CH_2Cl_2$, TCE and PCE

Maps showing soil gas sampling locations, concentrations and isoconcentration contour lines for $CH_2Cl_2$, TCE and PCE are attached as Figures 2 through 4. The distribution of these halogenated solvents and chloroform is not as widespread as that for TCA. These compounds give further evidence that the landfill is a source of subsurface halocarbon contamination. Concentrations as high as 3,400 ug/l ($CH_2Cl_2$ at SG-9) are consistent with soil gas concentrations from samples taken in contaminated soil, that is soil which physically contains the contaminant in question, and not just vapors. The highest concentrations were found in both the north and west sections of the landfill.

## Hydrocarbon Distribution

### Total Hydrocarbons

A map showing soil gas sampling locations including concentrations and isoconcentration contour lines for total hydrocarbons is attached as Figure 5. Contour lines again indicate that the northern section of the landfill is the major source of contamination. Landfills commonly have high concentrations of hydrocarbons in the soil gas from the natural biodegradation of wastes. High concentrations of petroleum specific hydrocarbons (benzene, toluene, ethyl benzene and xylenes) indicate that the amount of total hydrocarbons measured had a petroleum source. All locations which had petroleum specific hydrocarbon concentrations greater than .1 ug/l are contained within the 1000 ug/l total hydrocarbon contour.

Concentrations greater than 0.1 ug/l indicate other potential sources of hydrocarbon contamination north of the line defined by SG-36 through SG-40 and north of the line defined by SG-26 through SG-28. More soil gas work is needed directly upgradient (north) from the two areas mentioned above to check this possibility.

Figures A and B are a graphical representation of the diminution of contaminant concentration in the soil gas plotted vs. distance away from the source for TCA (Figure A) and total hydrocarbons (Figure B).

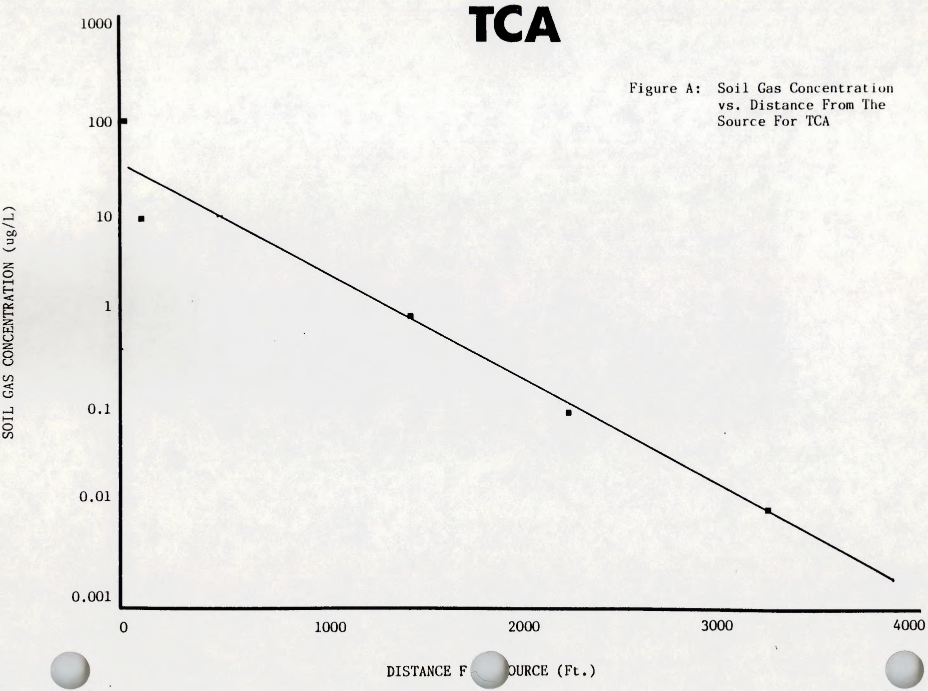

Figure A: Soil Gas Concentration vs. Distance From The Source For TCA

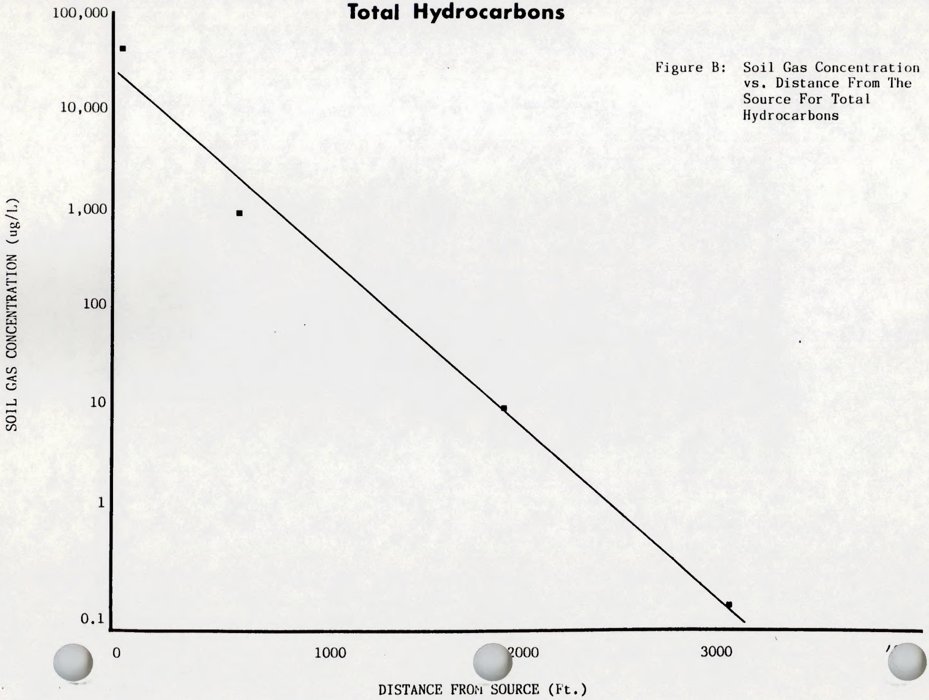

Figure B: Soil Gas Concentration vs. Distance From The Source For Total Hydrocarbons

## CONCLUSIONS

Results of this investigation indicate that the Lee Acres landfill is a source of both halocarbon and hydrocarbon contamination. Isoconcentration contour maps show VOCs migrating in a southerly direction towards wells which have been shown to be contaminated. Other potential sources of hydrocarbon contamination indicated by the soil gas survey include the El Paso Natural Gas facility and the Giant Refinery.

High concentrations found in the source areas indicate that the soil underlying the landfill is contaminated. That is, the soil actually contains the contaminant, not just its vapors. Knowing this fact, it is possible that the contamination is still diffusing downward in those areas, actively contaminating the groundwater.

# APPENDIX A: CONDENSED DATA

b Lee Acres Site, Farmington, New Mexico

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CONDENSED DATA

| CONTAMINANT | | | $CH_2Cl_2$ | $CHCl_3$ | TCA | TCE |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG1 | 6' | 7/8 | 260 | <0.07 | 8 | 2 |
| SG2 | 6' | 7/8 | <2 | <0.07 | 0.6 | 2 |
| SG3 | 6' | 7/8 | <2 | <0.07 | 24 | <0.06 |
| SG4 | 5.5' | 7/8 | <0.2 | <0.007 | 0.5 | <0.06 |
| SG5 | 5.5' | 7/8 | <0.2 | <0.007 | 30 | 6 |
| SG6 | 6' | 7/8 | <2 | <0.07 | 7 | 0.3 |
| SG7 | 5.5' | 7/8 | <2 | <0.07 | 4 | <0.06 |
| SG8 | 6' | 7/8 | 2,000 | <0.07 | 1 | <0.06 |
| SG9 | 6' | 7/8 | 3,400 | <0.07 | 180 | 60 |
| SG10 | 6' | 7/9 | <4 | <0.1 | 3 | 0.7 |
| SG11 | 6' | 7/9 | 5 | <0.07 | 0.1 | 11 |
| SG12 | 6' | 7/9 | 1 | <0.01 | 0.02 | 0.4 |
| SG13 | 6' | 7/9 | <0.04 | 0.02 | 0.4 | 0.02 |
| SG14 | 6' | 7/9 | <0.1 | 0.04 | 8 | <0.003 |
| SG15 | 6' | 7/9 | <0.1 | 0.5 | 0.08 | <0.003 |
| SG16 | 6' | 7/9 | <0.04 | <0.001 | 0.008 | <0.001 |
| SG17 | 6' | 7/9 | 0.4 | <0.001 | 0.2 | <0.001 |
| SG17 | 13' | 7/9 | 0.4 | <0.004 | 0.2 | <0.003 |
| SG18 | 6' | 7/9 | 12 | 0.3 | 5 | 11 |
| SG19 | 6' | 7/9 | <10 | 3 | 1 | 80 |
| SG20 | 6' | 7/9 | 300 | <0.004 | 0.1 | <0.003 |

Notations:

| | |
|---|---|
| RF | response factor |
| I | interference with adjacent peaks |
| NA | not analyzed |
| E | estinmated peak area |

Summarized by: L. Lawlor

Checked by: J. Olexa

Proofed by: L. Laplander

ob Lee Acres Site, Farmington, New Mexico

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Date_________ Page______

CONDENSED DATA

| CONTAMINANT | | | $CH_2Cl_2$ | $CHCl_3$ | TCA | TCE |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentratio |
| SG20D | 6' | 7/9 | 900 | <0.004 | 2 | 0.2 |
| SG21 | 6' | 7/9 | <0.04 | <0.001 | <0.003 | <0.001 |
| SG22 | 6' | 7/9 | <0.1 | <0.004 | 0.1 | <0.003 |
| SG23 | 6' | 7/9 | 1 | 0.1 | 0.6 | 0.3 |
| SG24 | 6' | 7/10 | NA | NA | NA | NA |
| SG24D | 6' | 7/10 | <0.04 | <0.001 | 0.2 | <0.0008 |
| SG25 | 6' | 7/10 | <0.01 | <0.0004 | 0.001 | <0.0002 |
| SG26 | 6' | 7/10 | <0.01 | 0.004 | 0.0008 | <0.0002 |
| SG27 | 6' | 7/11 | <0.01 | 0.0009 | 0.0007 | <0.0003 |
| SG28 | 6' | 7/11 | <0.01 | <0.0004 | 0.0004 | <0.0003 |
| SG29 | 6' | 7/10 | <0.01 | 0.008 | 0.002 | <0.0002 |
| SG30 | 5.5' | 7/10 | <0.01 | <0.0004 | 0.0004 | <0.0002 |
| SG31 | 6' | 7/10 | <0.01 | <0.0004 | 0.0004 | <0.0002 |
| SG32 | 6' | 7/10 | <0.01 | <0.0004 | 0.0004 | <0.0002 |
| SG33 | 6' | 7/10 | <0.01 | <0.0004 | 0.007 | <0.0002 |
| SG34 | 6' | 7/10 | <0.04 | <0.001 | 0.01 | <0.0008 |
| SG35 | 6' | 7/10 | <0.01 | 0.001 | <0.0001 | <0.0002 |
| SG36 | 6' | 7/11 | <0.01 | <0.0004 | 0.001 | <0.0003 |
| SG37 | 6' | 7/11 | <0.01 | <0.0004 | 0.0007 | <0.0003 |
| SG37D | 6' | 7/11 | <0.01 | <0.0004 | 0.0007 | <0.0003 |
| SG38 | 5.5' | 7/11 | <0.01 | 0.007 | 0.002 | <0.0003 |

| Notations: | | |
|---|---|---|
| | RF | response factor |
| | I | interference with adjacent peaks |
| | NA | not analyzed |
| | E | estinmated peak area |

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Proofed by: L. Laplander

b Lee Acres Site, Farmington, New Mexico

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## CONDENSED DATA

| CONTAMINANT | | | $CH_2Cl_2$ | $CHCl_3$ | TCA | TCE |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG39 | 6' | 7/11 | <0.01 | <0.0004 | 0.0005 | <0.0003 |
| SG40 | 6' | 7/11 | <0.01 | <0.0004 | 0.002 | <0.0003 |
| SG41 | 6' | 7/10 | <0.01 | 0.003 | 0.0006 | <0.0002 |
| SG42 | 6' | 7/10 | <0.01 | <0.0004 | 0.0006 | <0.0002 |

Notations:

| | |
|---|---|
| RF | response factor |
| I | interference with adjacent peaks |
| NA | not analyzed |
| E | estinmated peak area |

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b Lee Acres Site, Farmington, New Mexico

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CONDENSED DATA

| CONTAMINANT | | | PCE | | | |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG1 | 6' | 7/8 | 0.4 | | | |
| SG2 | 6' | 7/8 | 2 | | | |
| SG3 | 6' | 7/8 | 1 | | | |
| SG4 | 5.5' | 7/8 | <0.003 | | | |
| SG5 | 5.5' | 7/8 | 1 | | | |
| SG6 | 6' | 7/8 | 70 | | | |
| SG7 | 5.5' | 7/8 | 0.4 | | | |
| SG8 | 6' | 7/8 | 1 | | | |
| SG9 | 6' | 7/8 | 9 | | | |
| SG10 | 6' | 7/9 | 2 | | | |
| SG11 | 6' | 7/9 | 3 | | | |
| SG12 | 6' | 7/9 | 0.2 | | | |
| SG13 | 6' | 7/9 | 0.03 | | | |
| SG14 | 6' | 7/9 | 0.07 | | | |
| SG15 | 6' | 7/9 | 0.01 | | | |
| SG16 | 6' | 7/9 | 0.005 | | | |
| SG17 | 6' | 7/9 | 0.2 | | | |
| SG17 | 13' | 7/9 | 0.2 | | | |
| SG18 | 6' | 7/9 | 20 | | | |
| SG19 | 6' | 7/9 | 120 | | | |
| SG20 | 6' | 7/9 | 0.03 | | | |

Notations:

| | |
|---|---|
| RF | response factor |
| I | interference with adjacent peaks |
| NA | not analyzed |
| E | estinmated peak area |

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CONDENSED DATA

| CONTAMINANT | | | PCE | | | |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG20D | 6' | 7/9 | 0.3 | | | |
| SG21 | 6' | 7/9 | 0.003 | | | |
| SG22 | 6' | 7/9 | 0.2 | | | |
| SG23 | 6' | 7/9 | 0.8 | | | |
| SG24 | 6' | 7/10 | NA | | | |
| SG24D | 6' | 7/10 | 0.003 | | | |
| SG25 | 6' | 7/10 | <0.0002 | | | |
| SG26 | 6' | 7/10 | <0.00007 | | | |
| SG27 | 6' | 7/11 | 0.0002 | | | |
| SG28 | 6' | 7/11 | <0.00009 | | | |
| SG29 | 6' | 7/10 | <0.00007 | | | |
| SG30 | 5.5' | 7/10 | <0.00007 | | | |
| SG31 | 6' | 7/10 | <0.00007 | | | |
| SG32 | 6' | 7/10 | 0.001 | | | |
| SG33 | 6' | 7/10 | <0.00007 | | | |
| SG34 | 6' | 7/10 | 0.03 | | | |
| SG35 | 6' | 7/10 | <0.00007 | | | |
| SG36 | 6' | 7/11 | 0.002 | | | |
| SG37 | 6' | 7/11 | 0.0007 | | | |
| SG37D | 6' | 7/11 | 0.0008 | | | |
| SG38 | 5.5' | 7/11 | 0.0006 | | | |

Notations:

| | |
|---|---|
| RF | response factor |
| I | interference with adjacent peaks |
| NA | not analyzed |
| E | estinmated peak area |

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ob Lee Acres Site, Farmington, New Mexico

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CONDENSED DATA

| CONTAMINANT | | | PCE | | | |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentratic |
| SG39 | 6' | 7/11 | 0.0004 | | | |
| SG40 | 6' | 7/11 | 0.002 | | | |
| SG41 | 6' | 7/10 | <0.00007 | | | |
| SG42 | 6' | 7/10 | <0.00007 | | | |

Notations:
RF response factor
I interference with adjacent peaks
NA not analyzed
E estinmated peak area

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CONDENSED DATA

| CONTAMINANT | | | Benzene | Toluene | Ethyl Benzene | Ortho Xylene |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/1 concentration | mean ug/1 concentration | mean ug/1 concentration | mean ug/1 concentration |
| SG1 | 6' | 7/8 | <0.3 | 33 | <0.5 | <0.5 |
| SG2 | 6' | 7/8 | <0.1 | 3 | <0.09 | 0.1 |
| SG3 | 6' | 7/8 | <0.1 | <0.1 | <0.2 | <0.2 |
| SG4 | 5.5' | 7/8 | <0.06 | <0.07 | <0.09 | <0.1 |
| SG5 | 5.5' | 7/8 | <0.1 | <0.1 | <0.2 | <0.2 |
| SG6 | 6' | 7/8 | <0.3 | 8 | <0.5 | <0.5 |
| SG7 | 5.5' | 7/8 | <0.06 | <0.07 | <0.09 | <0.1 |
| SG8 | 6' | 7/8 | <0.1 | <0.2 | <0.2 | <0.3 |
| SG9 | 6' | 7/8 | <0.1 | <4 | 320 | <5 |
| SG10 | 6' | 7/9 | <7 | 60 | <7 | <7 |
| SG11 | 6' | 7/9 | <7 | 80 | <7 | <7 |
| SG12 | 6' | 7/9 | <1 | <1 | <1 | <1 |
| SG13 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG14 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG15 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG16 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG17 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG17 | 13' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG18 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG19 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG20 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |

Notations:

| | |
|---|---|
| RF | response factor |
| I | interference with adjacent peaks |
| NA | not analyzed |
| E | estinmated peak area |

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CONDENSED DATA

| CONTAMINANT | | | Benzene | Toluene | Ethyl Benzene | Ortho Xylene |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG20D | 6' | 7/9 | 1 | 0.8 | <0.03 | <0.03 |
| SG21 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG22 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG23 | 6' | 7/9 | <0.03 | <0.04 | <0.04 | <0.03 |
| SG24 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG24D | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG25 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG26 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG27 | 6' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG28 | 6' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG29 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG30 | 5.5' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG31 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG32 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG33 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG34 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG35 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG36 | 6' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG37 | 6' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG37D | 6' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG38 | 5.5' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |

| Notations: | | |
|---|---|---|
| | RF | response factor |
| | I | interference with adjacent peaks |
| | NA | not analyzed |
| | E | estinmated peak area |

Summarized by: L. Lawlor

Checked by: J. Olexa

Proofed by: L. Laplander

Job Lee Acres Site, Farmington, New Mexico

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CONDENSED DATA

| CONTAMINANT | | | Benzene | Toluene | Ethyl Benzene | Ortho Xylene |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentratio |
| SG39 | 6' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG40 | 6' | 7/11 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG41 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |
| SG42 | 6' | 7/10 | <0.03 | <0.03 | <0.03 | <0.03 |

Notations:

| | |
|---|---|
| RF | response factor |
| I | interference with adjacent peaks |
| NA | not analyzed |
| E | estinmated peak area |

Summarized by: L. Lawlor

Checked by: J. Olexa

Proofed by: L. Laplander

Lee Acres Site, Farmington, New Mexico

TRACER RESEARCH CORPORA

Date________ Page________

CONDENSED DATA

| CONTAMINANT | | | Total Hydrocarbons | | | |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG1 | 6' | 7/8 | 4900 | | | |
| SG2 | 6' | 7/8 | 730 | | | |
| SG3 | 6' | 7/8 | 350 | | | |
| SG4 | 5.5' | 7/8 | 46 | | | |
| SG5 | 5.5' | 7/8 | 450 | | | |
| SG6 | 6' | 7/8 | 1100 | | | |
| SG7 | 5.5' | 7/8 | 80 | | | |
| SG8 | 6' | 7/8 | 3800 | | | |
| SG9 | 6' | 7/9 | 50000 | | | |
| SG10 | 6' | 7/9 | 6800 | | | |
| SG11 | 6' | 7/9 | 140000 | | | |
| SG12 | 6' | 7/9 | 8400 | | | |
| SG13 | 6' | 7/9 | 0.6 | | | |
| SG14 | 6' | 7/9 | 0.7 | | | |
| SG15 | 6' | 7/9 | 16 | | | |
| SG16 | 6' | 7/9 | 0.2 | | | |
| SG17 | 6' | 7/9 | 0.2 | | | |
| SG17 | 13' | 7/9 | 0.2 | | | |
| SG18 | 6' | 7/9 | 7 | | | |
| SG19 | 6' | 7/9 | 73 | | | |
| SG20 | 6' | 7/9 | 0.7 | | | |

Notations:
RF response factor
I interference with adjacent peaks
NA not analyzed
E estinmated peak area

Summarized by: L. Lawlor

Checked by: D. Evans

Proofed by: D. Evans

Lee Acres Site, Farmington, New Mexico

Date__________ Page________

CONDENSED DATA

| CONTAMINANT | | | Total Hydrocarbons | | | |
|---|---|---|---|---|---|---|
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG20D | 6' | 7/9 | 31 | | | |
| SG21 | 6' | 7/9 | 0.1 | | | |
| SG22 | 6' | 7/9 | 0.6 | | | |
| SG23 | 6' | 7/9 | 0.9 | | | |
| SG24 | 6' | 7/10 | 0.1 | | | |
| SG24D | 6' | 7/10 | 0.04 | | | |
| SG25 | 6' | 7/10 | 0.02 | | | |
| SG26 | 6' | 7/10 | 0.8 | | | |
| SG27 | 6' | 7/11 | 0.4 | | | |
| SG28 | 6' | 7/11 | 0.3 | | | |
| SG29 | 6' | 7/10 | 0.06 | | | |
| SG30 | 5.5' | 7/10 | 0.08 | | | |
| SG31 | 6' | 7/10 | 0.09 | | | |
| SG32 | 6' | 7/10 | 0.3 | | | |
| SG33 | 6' | 7/10 | 0.02 | | | |
| SG34 | 6' | 7/10 | 0.02 | | | |
| SG35 | 6' | 7/11 | 0.3 | | | |
| SG36 | 6' | 7/11 | 0.3 | | | |
| SG37 | 6' | 7/11 | 0.5 | | | |
| SG37D | 6' | 7/11 | 0.2 | | | |
| SG38 | 5.5' | 7/11 | 0.3 | | | |

| Notations: | |
|---|---|
| RF | response factor |
| I | interference with adjacent peaks |
| NA | not analyzed |
| E | estinmated peak area |

Summarized by: L. Lawlor

Checked by: D. Evans

Proofed by: D. Evans

Lee Acres Site, Farmington, New Mexico

Date__________ Page________

CONDENSED DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| CONTAMINANT | | | Total Hydrocarbons | | | |
| sample | depth | date | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration | mean ug/l concentration |
| SG39 | 6' | 7/11 | 0.03 | | | |
| SG40 | 6' | 7/11 | 0.4 | | | |
| SG41 | 6' | 7/10 | 0.09 | | | |
| SG42 | 6' | 7/10 | 0.02 | | | |
| | | | | | | |
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Notations:
RF response factor
I interference with adjacent peaks
NA not analyzed
E estinmated peak area

Summarized by: L. Lawlor

Checked by: D. Evans

Proofed by: D. Evans

Figure 1. Trichloroethane (TCA) in Soil Gas.
BUREAU OF LAND MANAGEMENT
Contract AA852-RP6-7
LEE ACRES SITE, NEW MEXICO

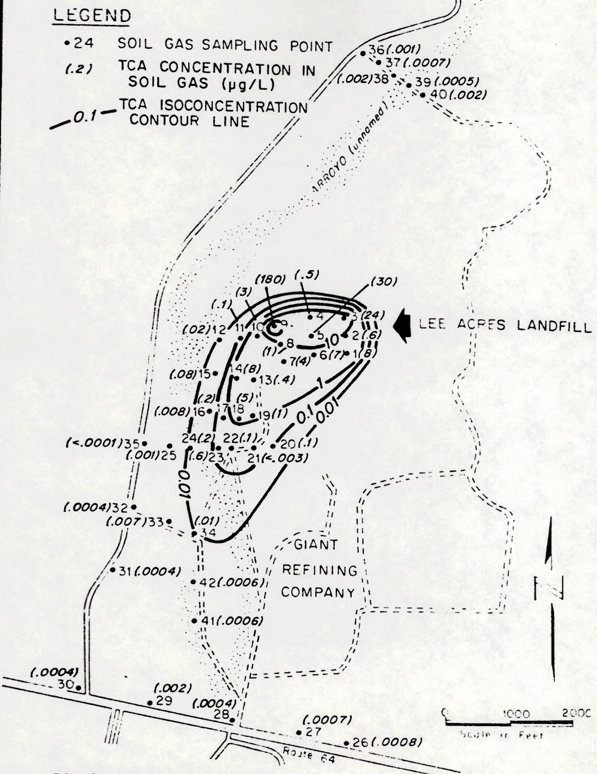
LEGEND
•24 SOIL GAS SAMPLING POINT
(.2) TCA CONCENTRATION IN SOIL GAS (µg/L)
0.1 TCA ISOCONCENTRATION CONTOUR LINE
36(.001)
37(.0007)
(.002)38
39(.0005)
40(.002)
ARROYO (unnamed)
(180)
(.5)
(30)
(3)
(.1)
(24)
(.02)12
11
10
9
4
3
2(.6)
8
5
10
(1)
7(4)
6(7)
1(8)
LEE ACRES LANDFILL
(.08)15
14(8)
13(.4)
1
(.2)
(5)
(.008)16
17
18
19(1)
0.1
0.01
(<.0001)35
(.001)25
24(.2)
22(.1)
20(.1)
(.6)23
21(<.003)
0.01
(.0004)32
(.007)33
(.01)
34
GIANT REFINING COMPANY
31(.0004)
42(.0006)
41(.0006)
N
(.0004)
30
(.002)
29
(.0004)
28
(.0007)
27
26(.0008)
Route 64
0
1000
2000
Scale in Feet

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Figure 2. Methylene Chloride ($CH_2Cl_2$) in Soil Gas.
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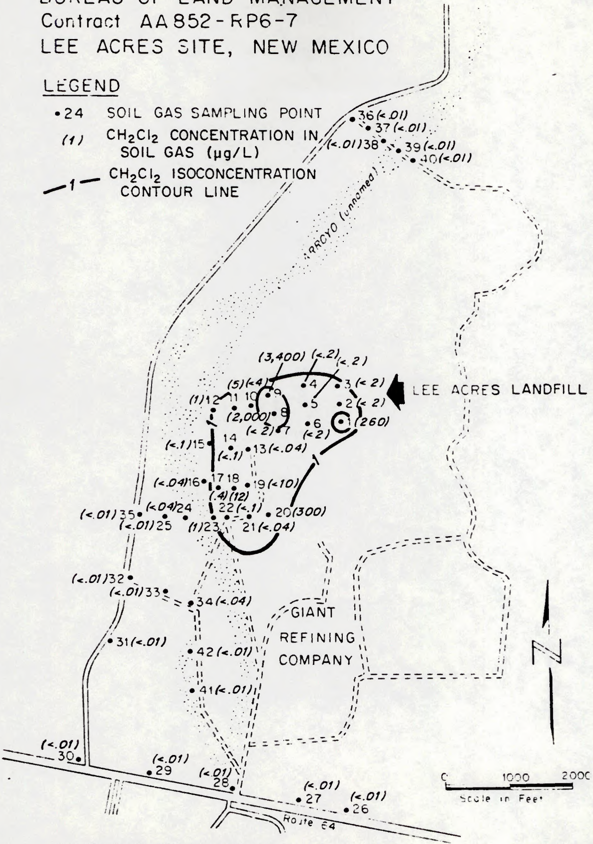
LEGEND
•24 SOIL GAS SAMPLING POINT
(1) CH2Cl2 CONCENTRATION IN SOIL GAS (µg/L)
—1— CH2Cl2 ISOCONCENTRATION CONTOUR LINE
ARROYO (unnamed)
LEE ACRES LANDFILL
GIANT REFINING COMPANY
N
0 1000 2000
Scale in Feet
Route 64
36(<.01)
37(<.01)
(<.01)38
39(<.01)
40(<.01)
(3,400)
(<.2)
(<.2)
(5)(<4)
(1)12
11
10
9
4
3(<2)
5
2(<2)
(2,000)
8
6
(<2)
1(260)
(<2) 7
14
(<.1)15
(<.1)
13(<.04)
1
(<.04)16
17 18
(.4)(12)
19(<10)
(<.01)35
(<.04)24
22(<.1)
20(300)
(<.01)25
(1)23
21(<.04)
(<.01)32
(<.01)33
34(<.04)
31(<.01)
42(<.01)
41(<.01)
(<.01) 30
(<.01) 29
(<.01) 28
(<.01) 27
(<.01) 26

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Figure 3. Trichloroethylene (TCE) in Soil Gas.
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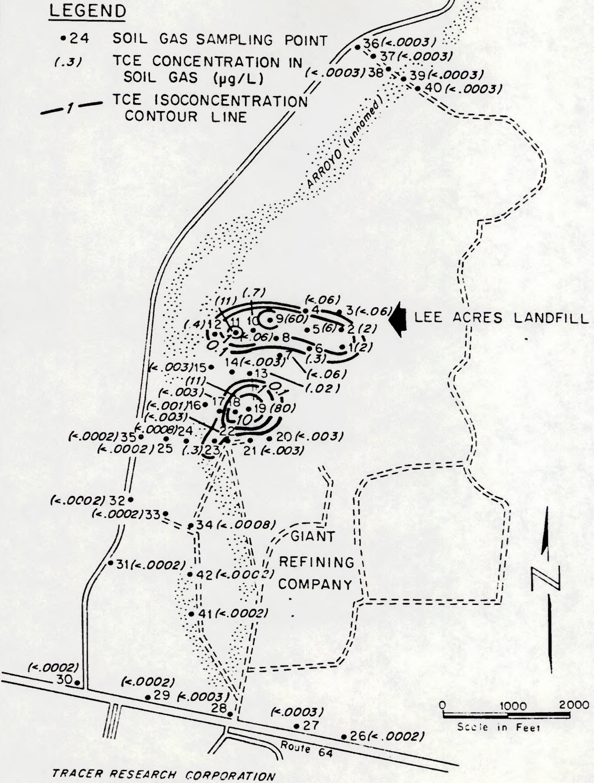
LEGEND
•24 SOIL GAS SAMPLING POINT
(.3) TCE CONCENTRATION IN SOIL GAS (µg/L)
—1— TCE ISOCONCENTRATION CONTOUR LINE
36(<.0003)
37(<.0003)
(<.0003)38
39(<.0003)
40(<.0003)
ARROYO (unnamed)
(11)
(.7)
(<.06)
(.4)12
11
10
9(60)
4
3(<.06)
LEE ACRES LANDFILL
5(6)
2(2)
7(<.06)
8
6
1(2)
0.1
(.3)
(<.003)15
14(<.003)
13
(<.06)
(.02)
(11)
(<.003)
(<.001)16
17
18
19(80)
0.1
1
10
(<.003)
(<.0008)24
22
20(<.003)
(<.0002)35
(<.0002)25
(.3)23
21(<.003)
(<.0002)32
(<.0002)33
34(<.0008)
GIANT REFINING COMPANY
31(<.0002)
42(<.0002)
41(<.0002)
N
(<.0002)
30
(<.0002)
29
(<.0003)
28
(<.0003)
27
26(<.0002)
Route 64
0 1000 2000
Scale in Feet

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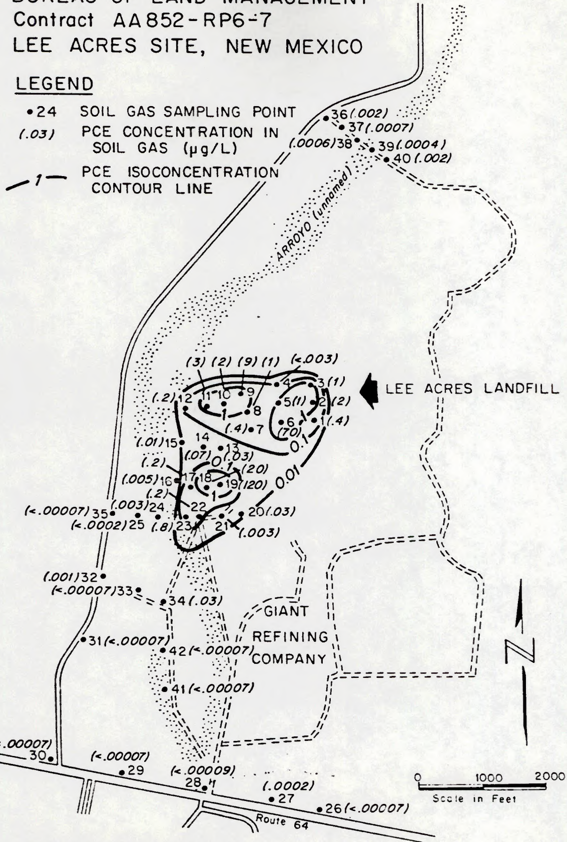
Figure 4. Perchloroethylene (PCE) in Soil Gas.
BUREAU OF LAND MANAGEMENT
Contract AA852-RP6-7
LEE ACRES SITE, NEW MEXICO



LEGEND
•24 SOIL GAS SAMPLING POINT
(.03) PCE CONCENTRATION IN SOIL GAS (μg/L)
1 PCE ISOCONCENTRATION CONTOUR LINE
36(.002)
37(.0007)
(.0006)38
39(.0004)
40(.002)
ARROYO (unnamed)
(3) (2) (9) (1) (<.003)
4
3(1)
LEE ACRES LANDFILL
(.2)12
11
10
9
8
5(1)
2(2)
6
(70)
1(.4)
(.4)7
(.01)15
14
13
(.07)
(.03)
0.1
(.2)
1
(20)
0.1
(.005)16
17
18
19(120)
0.01
(.2)
22
1
(<.00007)35
(.003)24
20(.03)
(<.0002)25
(.8)23
21
(.003)
(.001)32
(<.00007)33
34(.03)
GIANT REFINING COMPANY
31(<.00007)
42(<.00007)
41(<.00007)
N
(<.00007)
30
(<.00007)
29
(<.00009)
28
(.0002)
27
26(<.00007)
Route 64
0 1000 2000
Scale in Feet

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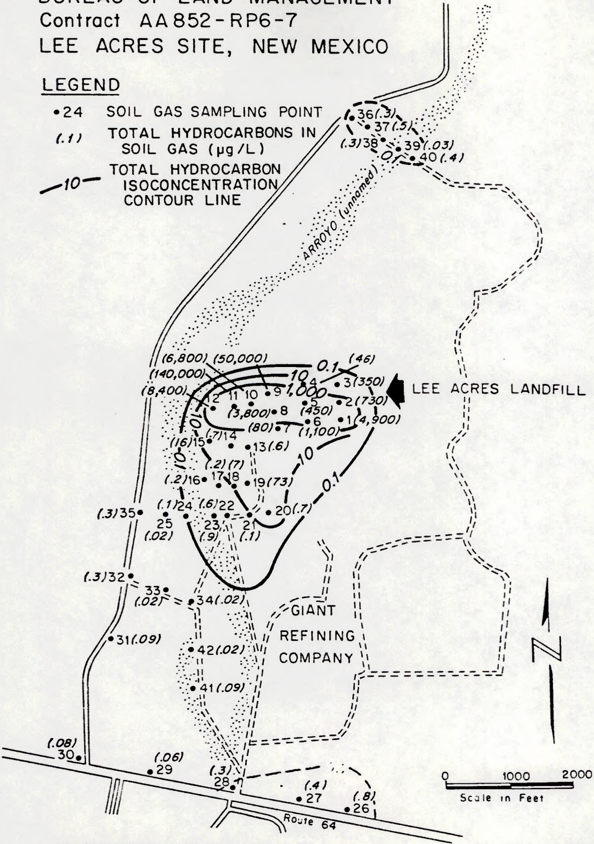
Figure 5. Total Hydrocarbons in Soil Gas.
BUREAU OF LAND MANAGEMENT
Contract AA852-RP6-7
LEE ACRES SITE, NEW MEXICO


LEGEND
•24 SOIL GAS SAMPLING POINT
(.1) TOTAL HYDROCARBONS IN SOIL GAS (µg/L)
10 TOTAL HYDROCARBON ISOCONCENTRATION CONTOUR LINE
ARROYO (unnamed)
LEE ACRES LANDFILL
GIANT REFINING COMPANY
Route 64
0 1000 2000
Scale in Feet
N
36(.3)
37(.5)
(.3)38
39(.03)
40(.4)
0.1
(6,800)
(50,000)
(140,000)
(8,400)
(46)
3(350)
2(730)
1(4,900)
4
9
10
11
12
1,000
(3,800) 8
5 (450)
6 (1,100)
(80) 7
(.7)14
(16)15
13(.6)
(.2)(7)
(.2)16
17
18
19(73)
(.1)24
(.6)22
20(.7)
(.3)35
25 (.02)
23 (.9)
21 (.1)
(.3)32
33 (.02)
34(.02)
31(.09)
42(.02)
41(.09)
(.08) 30
(.06) 29
(.3) 28
(.4) 27
(.8) 26
10
0.1

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